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**Screening for Drugs in Oral Fluid:
Drug Driving and Illicit Drug Use in a Sample of Queensland Motorists**

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Keywords: drug driving, oral fluid, roadside drug screening

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ABSTRACT

Objective: Random roadside oral fluid testing is becoming increasingly popular as an apprehension and deterrence-based countermeasure to reduce drug driving. This paper outlines research conducted to provide an estimate of the extent of drug driving in a sample of drivers in Brisbane, Queensland.

Methods: Oral fluid samples were collected from 1587 drivers who volunteered to participate at Random Breath Testing (RBT) sites. Illicit substances tested for included cannabis (delta 9 tetrahydrocannabinol [THC]), meth/amphetamines and cocaine. Drivers also completed a self-report questionnaire regarding their drug-related driving behaviour.

Results: Oral fluid samples from 58 participants (3.7%) were confirmed positive for at least one illicit substance. The most common drugs detected in oral fluid were ecstasy ($n = 35$) followed by cannabis ($n = 20$). Similarly, cannabis was confirmed as the most common self-reported drug combined with driving. Nevertheless, individuals who tested positive to any drug through oral fluid analysis were also more likely to report the highest frequency of drug driving.

Conclusions: This research provides evidence that drug driving is relatively prevalent on some Queensland roads, and thus the behaviour presents as a serious road safety threat. This paper will further outline the study findings and present possible directions for future drug driving research.

Keywords: drug driving, oral fluid, roadside drug screening

INTRODUCTION

In recent years, an increasing body of literature has focused on ascertaining the incidences and effect of drug driving on road safety. A significant amount of research is accruing that has focused on identifying the presence of drugs in body fluids of those who have been involved in a crash. This research has demonstrated that between 8.8 and 26.7 percent of drivers fatally injured in crashes have drugs detected in their body fluid and between 2.7 to 41.3 percent of non-fatally injured drivers in traffic crashes also test positive to illicit substances (Del Rio et al., 2002; Drummer et al., 2003; Mura et al., 2006; Seymour & Oliver, 1999; Swann et al., 2004). Furthermore within Australia, a study of fatalities on the roads indicated 26.7 per cent of motorists killed had drugs other than alcohol detected in body fluids (Drummer et al., 2003). However, the percentage of the general driving population (not involved in crashes) that are driving after consuming drugs remains unclear due to difficulties testing for drugs and detecting motorists driving under the influence.

The main avenue for obtaining such information has traditionally been through self-report data provided by motorists. A considerable body of research has indicated that the self-reported prevalence of drug driving varies markedly between 2 and 90 percent of respondents, although most research suggests between 3 and 10 percent (Kelly et al., 2004). This variation is dependent upon whether respondents have been referring to drug driving in general or to a specific substance. Despite this, research is generally indicating that the most common drugs combined with driving are usually cannabis (Davey et al., 2007; Drummer et al., 2003; Terry & Wright, 2005), which may in part be associated with perceptions that cannabis does not have a negative impact on driving performance (Terry & Wright, 2005). Although, amphetamine use and driving are also frequently combined among some groups (Albery et al., 2000; Davey et al., 2007; Darke et al., 2004). Additionally, it is noted that a limitation of this body of research is that such studies have predominantly consisted of cannabis users.

Nevertheless, drug driving appears prevalent in Australia, as a growing body of research has indicated some motorists drive after consuming illicit drugs (Armstrong et al., 2005; Darke et al., 2004; Davey et al., 2007; Hawkins et al., 2004; Jones et al., 2005; Mallick et al., 2007). A large contemporary Australian study of 6801 drivers revealed that 12.3 percent of the sample reported driving within 3 hours of using cannabis in the past 12 months and a considerable proportion of the

sample reported poly drug use (Mallick et al., 2007). And similar to above, illicit drug users were more likely to perceive there to be less risks associated with drug driving than non-users (Mallick et al., 2007). Additionally, smaller Australian studies that have focused on young drivers (e.g., university students) have also revealed similar results, as between 8.2 and 15 percent of motorists reported driving after consuming some form of illicit substance on a yearly basis (Armstrong et al., 2005; Davey et al., 2005a).

However, the development and use of oral fluid in drug testing for roadside use has greatly increased the likelihood of more accurately determining the prevalence of drug driving, as sample collection is relatively simple and non-invasive (Dolan et al., 2004; Speedy et al., 2004). Previous research concerning body fluid sample analysis has focused on samples of drivers alleged to have been driving under the influence of drugs and/or those involved in vehicle crashes. However, more recently, research has commenced focusing on random roadside drug testing which is beginning to provide an estimate of the extent of drug driving on public roads, including those who are not involved in crashes. One recent study in this area reported 4.7 percent of drivers from a random sample of non-crash drivers in Britain, were confirmed positive to the presence of drugs (Buttress et al., 2004). Additionally, a study conducted in Germany found a significant proportion (16.8%) of drivers were confirmed positive for at least one drug (Wylie et al., 2005).

One of the few Australian studies in this area was conducted by the Victorian police who recorded a drug driving prevalence rate of one driver in 40 (2.4%) for cannabis and amphetamines, which is more than double the positive alcohol-driving rate (Drummer et al., 2007). Davey et al. (2007) also examined the extent of drug driving in Townsville (Queensland) and reported 3.5 percent of the sample tested positive to one illicit substance, which was again in fact greater than the detection of drink drivers during the same testing period (e.g., 0.8%). Interestingly, a three-year study of police traffic detainees in three Australian states found that 70 percent tested positive to one drug and approximately one third (e.g., 38%) tested positive to more than one drug (Poyser et al., 2002). A similar Australian study that examined motorists involved in traffic accidents revealed that 16.4 percent of injured drivers tested positive to tetrahydrocannabinol and 6.9 percent tested positive to amphetamines (Caldicott et al., 2007). These preliminary findings indicate that drug driving presents as a serious threat to road safety, and additionally prompts the need for further research to determine

the extent of non-crash drug driving rates in Australia, especially for drugs such as cannabis, amphetamine, ecstasy, and cocaine.

As a result, the major objectives of this study were to:

- Measure the extent of drug driving among a sample of Queensland drivers in the city of Brisbane; and
- Investigate the self-reported frequency of general motorists' involvement in drug driving behaviour

METHOD

Participants, Materials and Procedure

Drivers stopped at Random Breath Testing (RBT) operations across the city of Brisbane were approached and asked by operational police to participate in the drug driving research project, which was positioned on average 50 metres further down the road. Participation was voluntary and involved completing a self-report questionnaire regarding recent illicit drug use and drug driving in the previous 12 months, and providing a sample of oral fluid that could later be screened for the presence of drugs. The procedure took approximately 10-20 minutes to complete and drivers received a one-off payment of \$20 cash to reimburse them for their time. Data was collected over a two month period, on ten separate occasions, usually between the hours of 5pm and 1am¹.

A 12 item self-report questionnaire was designed to assess a variety of demographic data (e.g., gender, age, years driving) as well as self-reported drug use and the frequency of drug driving behaviour. Participants responded to questions that investigated the most recent use of marijuana / cannabis (within four hours, within the last 24 hours, within the last week, within the last month, within the last year, more than a year ago, have never used). This question was repeated for amphetamines (such as speed, oil, base, crystal, ecstasy), heroin and cocaine. Participants were also required to indicate how often in the previous 12 months they had operated a motor vehicle (including a motorcycle) within four hours of using marijuana / cannabis (every day, more than once a week, about once a week, 11 – 20 times, 3 – 10 times, once or twice, never). Once again, this question was

¹ Workplace health and safety requirements resulted in the current roadside project only being implemented with the presence of the Queensland Police Service. RBT operations were deemed to be the most compatible roadside activity and thus drug testing procedures corresponded within traditional RBT operational hours e.g., 5pm – 1am.

repeated for amphetamines (such as speed, oil, base, crystal, ecstasy), heroin and cocaine. The majority of data was descriptive and/or categorical, and recorded as percentage frequencies, and thus, chi-square tests were performed where appropriate.

In addition, oral fluid samples were collected, stored and screened off-site at a later date using the Cozart® RapiScan oral fluid drug test device. Participants provided a sample of oral fluid that was collected from inside their mouth via a pad held either under their tongue or beside the inside of their cheek. The five-panel cannabis and single-panel methamphetamine / MDMA test cartridges were used (i.e. each sample was screened twice). Each Cozart® RapiScan kit consisted of a collector, transport tube containing buffer solution, separator filter tube, pipette and test cartridge. The five-panel cannabis cartridge detected the presence of benzodiazepines, amphetamines, cannabis (THC), and cocaine, while the single-panel methamphetamine / MDMA cartridge detected the presence of methamphetamine and MDMA (ecstasy). There was no subjectivity in the interpretation of results as the Cozart® RapiScan testing instrument displayed and printed results.

RESULTS

Sample and Response Rate

A total of 1587 motorists from the Brisbane area volunteered to participate in the study. Over the entire data collection stage, it was difficult to acquire an accurate measurement of the proportion of responses due to resourcing restrictions and the referral procedure from the Police RBT location². However, on one occasion in the Brisbane region the response rate was assessed across two sites during a shift where an additional researcher counted the number of drivers approached to participate and noted their response. Drivers of 65 cars from a total of 91 participated in the project, resulting in a response rate of 71.42 percent. In addition, over the entire study, six potential participants approached the research site, but declined to participate after being informed about the research procedure.

Overall, the sample consisted of both male and female participants with more than half being male ($n = 1004$, 63.3%), aged between 16 and 75 years (mean age = 30.06 years, $SD = 12.02$). On average, participants had been driving for 12.06 years ($SD = 11.30$) and the majority of the sample reported driving daily ($n = 1353$, 85.3%) or three to five times per week ($n = 197$, 12.4%).

² The procedure usually consisted of RBT operational police officers informing motorists (who had given a breath sample) that they had the opportunity to participate in an anonymous research drug driving project being conducted approximately 50 metres down the road.

Extent of Positive Drug Screening Tests

Drug screening tests revealed that oral fluid samples from 58 drivers (3.7% of the total sample) contained at least one illicit substance. Table 1 summarises the findings by drug group detected and gender of the driver. As depicted in Table 1, the most frequent drug detected was ecstasy, followed by cannabis, while samples from 15 participants were consistent with poly drug use.

Juxtaposed with the total sample, the 58 drivers who provided samples that were screened positive for at least one illicit substance were more likely to be male ($n = 47$, 81%), and aged between 17 and 53 (mean = 26.1 years, $SD = 8.5$), but had similar driving experience as the sample average (mean = 8.68 years, $SD = 8.68$). Rates of driving was similar, as most reported driving daily ($n = 52$, 89.7%) or three to five times per week ($n = 4$, 6.9%). In general, the prevalence of drug driving was higher among males than females, ($n = 47$, 81%) especially among poly drug users ($n = 12$, 80%).

INSERT TABLE 1 HERE

Self-reported Extent of Drug Driving

In conjunction with the analysis of body fluids, an analysis was also undertaken to investigate participants' self-reported drug use and drug driving behaviours. Firstly for drug use, the most commonly consumed drug was cannabis, with 21.3% reporting the use of the substance within the last year, and 3.2% of this group reporting usage in the last week. In contrast, only 7.9% reported amphetamine use in the last year, with 0.7% using the substance in the last week. Ecstasy use however, was the 2nd most commonly consumed drug with 10.6% reporting the use of the substance within the last year, and 0.7% using the substance in the last week. Finally, 3.2% reported using cocaine and 0.4% of the sample reported using heroin during the last year. Chi-square analysis revealed males were more likely to report regular cannabis use than females $\chi^2 (6, N=1587, =19.723, p = .003)$, while small cell sizes precluded analysis of the other substances.

For self-reported drug driving, the most common substance was cannabis (see Table 2). More specifically, 4.1% reported using cannabis before driving at least once a week, while less than 1.0% reported the use of amphetamines, ecstasy, cocaine or heroin before driving. Finally, examination of the self-reported drug use for the individuals who tested positive to the presence of drugs revealed

that drug driving was most common among these individuals. For example, 44 (75.9%) reported driving within four hours of using at least one of the drugs outlined on the questionnaire. This proportion is more than five times the proportion of the total sample of 1587 drivers that reported drug driving (221 drivers, 13.9%). Furthermore, 32 (55.2%) of the drivers who provided samples that were confirmed positive for at least one illicit substance reported drug driving frequently (that is, once a week or more). This is more than 9 times the proportion of the total sample that reported frequently drug driving (93 drivers, 5.9%).

INSERT TABLE 2 HERE

DISCUSSION

The central aim of this paper was to report on an investigation into the incidences of drug driving in a major city of Queensland. More specifically, the study focused on measuring the self-reported extent of drug driving in the community and the major drug types that may be used when driving.

Extent of Positive Drug Tests

The first major finding of the study was that the examination of oral fluid samples revealed that 3.7% ($n = 58$) of the sample provided a positive illicit drug reading. The finding is consistent with the small amount of research that has focused on randomly drug testing motorists through oral fluid analysis (Buttress et al., 2004; Davey et al., 2007; Drummer et al., 2007). In addition, the detection rate for drug drivers (in the current case) appears higher than the recent detection rates for drink drivers in Queensland (Davey et al., 2007; Watson et al., 2005). However, it is noted that these findings are only preliminary and the data sample for the current study focuses specifically on a metropolitan city. Nevertheless, the results suggest that a considerable proportion of drivers may be at risk of driving under the influence of drugs, rather than alcohol, in the early hours of the morning. In regards to the characteristics of the drivers most likely to test positive to illicit substances, such individuals were significantly more likely to be males, and under 30 years of age. The results are consistent with general drug research that has consistently indicated that males are more likely to consume illicit substances than females (Begg and Langley, 2004; Neale, 2004), and in particular, engage in poly drug use (Milani, Parrott, Turner & Fox, 2004).

Two types of drugs were detected: ecstasy (MDMA) and cannabis (delta 9 THC). Firstly, ecstasy (MDMA) was the most common illicit substance identified in the current sample. This finding is in contrast to similar recent research conducted in Queensland that indicated that cannabis was the most commonly combined drug with driving (Davey et al., 2007), although it is noted this difference may be heavily dependent upon specific locations. Additionally, the sample size as well as the differences identified between the different drug types was relatively small, and thus the findings need to be replicated with larger samples sizes.

Self-reported Drug Driving

Examination of the self-reported data revealed that cannabis, rather than amphetamines, was the most frequently consumed illicit substance, and not surprisingly, was also the most frequent drug to be used when driving. The findings support previous research that has indicated cannabis to be the most prevalent drug associated with driving (Davey et al., 2007; Drummer et al., 2003; Seymour & Oliver, 1999; Swann et al., 2004). Importantly, individuals who tested positive to the drug testing process also reported the highest rate of drug driving. Therefore, the findings also provide preliminary evidence that positive drug testing outcomes highlight individuals at risk of regularly engaging in drug driving activity, and to a lesser extent, provide support for the reliability of the self-report data.

Limitations

Some methodological limitations associated with the study should be borne in mind when interpreting the findings. The results of the study may not be generalisable, as a sample from only one area of Queensland (a metropolitan city) was utilised in the research project. It is possible that drug use (and therefore, drug driving) trends may vary by area, due to differences in the supply, demand, cost and potency of drugs. Additionally, the Queensland Police Service generally utilise intelligence-led apprehension initiatives, and thus they conduct RBTs in high risk areas (e.g., around licensed areas), which most likely also positively influenced the number of identified drugged drivers. Furthermore, the drug testing procedures utilised in the current study only categorised participants into positive and negative groups, while future advancements in screening technology may provide an indication of the level of impairment which is similar to BAC readings. And, although a wide age range was observed, the sample was skewed towards younger age groups ($M = 22$ years). It would have been ideal to have sampled a group of drivers more representative of all Queensland drivers, however due to the

voluntary nature of the study, this did not occur. However importantly, the sample of this study may prove to be representative of drivers at night on weekends, which is actually a peak drug driving period. However, given that data was only collected between the hours of 5pm and 1am, it is possible that drug driving rates may increase or decrease further into the early hours of the morning, as well as during the day. Furthermore, the possibility of self-report and volunteer bias remains, and although the Queensland Police Service were not directly involved in the research project, it is possible that operational officers' presence at the research site deterred some individuals from participating (especially those under the influence of drugs), and exact refusal rates were not obtained. Questions also remain about the accurateness of saliva testing for illicit drugs, as environmental contamination may negatively affect the accuracy of oral testing e.g., presence in a room where cannabis is being smoked (e.g., Davey et al., 2007).

Nevertheless, this research provides evidence that drug driving is relatively prevalent on some Queensland roads, and given that research has linked illicit substances with crash involvement, drug driving presents as a serious road safety threat. Additionally, considering that previous research has indicated that perceptions of apprehension uncertainty are a key element in deterring both drink drivers (Piquero & Pogarsky, 2002) and drug drivers (Davey et al., 2005b) from engaging in such offending behaviours, drug testing through random roadside saliva techniques has the potential to become a viable method to increase perceptions of apprehension uncertainty and thus reduce driving under the influence of illicit drugs. As a result, it would be beneficial to examine motorists' current perceptions regarding the likelihood of being detected for drug driving, and their corresponding beliefs about the effectiveness, and impact, of saliva testing on offending rates. Such information would assist in the current implementation of new random road side testing techniques being conducted in Queensland, as well as the promotion of the countermeasure and corresponding drug driving legislation. It is noteworthy that researchers have suggested that the Australian community is currently not adequately aware of the dangers associated with drug driving (Mallick et al., 2007), and that further research is required into identifying the most effective mediums to increase motorists' perceptions regarding the deleterious impact illicit substances have on driving performance. In summary, further investigation into drug use and drug driving can only assist with the development and implementation of effective countermeasures and supportive enforcement practices aimed at reducing the burden of drug driving on road safety.

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List of Tables

Table 1. *Number and Proportion of Positive Drug Screening by Drug Group*

	Total ³ N = 1587	Males N = 1004	Females N = 573
Ecstasy (MDMA)	35 (2.2%)	28 (2.8%)	7 (1.2%)
Cannabis (THC)	20 (1.3%)	17 (1.7%)	3 (0.5%)
Amphetamines	17 (1.1%)	14 (1.4%)	3 (0.5%)
Cocaine	2 (0.1%)	1 (0.1%)	1 (0.2%)
Total Illicit Substances ⁴	74 (4.6%)	60 (6.0%)	14 (2.4%)

Table 2. *Drug Driving Behaviour*

Drug Type	Cannabis		Amphetamine		Ecstasy		Cocaine		Heroin	
	n	%	n	%	n	%	n	%	n	%
Drug Driving										
Every Day	26	(1.6)	3	(0.2)	1	(0.1)	0	(0.0)	0	(0.0)
More than once a week	20	(1.3)	3	(0.2)	6	(0.4)	0	(0.0)	1	(0.1)
About once a week	19	(1.2)	12	(0.8)	4	(0.3)	0	(0.0)	0	(0.0)
11-20 times	14	(0.9)	12	(0.8)	7	(0.4)	6	(0.4)	0	(0.0)
3-10 times	18	(1.1)	12	(0.8)	20	(1.3)	5	(0.3)	4	(0.3)
Once or twice	76	(4.8)	28	(1.8)	58	(3.7)	22	(1.4)	5	(0.3)
Never	1399	(88.2)	1509	(95.1)	1481	(93.3)	1545	(97.4)	1568	(98.8)

³ 10 respondents did not provide their gender.

⁴ 15 respondents screened positive to more than one drug.